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Humanizing sociotechnical transitions through energy justice: An ethical framework for global transformative change

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ABSTRACT

Poverty, climate change and energy security demand awareness about the interlinkages between energy systems and social justice. Amidst these challenges, energy justice has emerged to conceptualize a world where all individuals, across all areas, have safe, affordable and sustainable energy that is, essentially, socially just. Simultaneously, new social and technological solutions to energy problems continually evolve, and interest in the concept of sociotechnical transitions has grown. However, an element often missing from such transitions frameworks is explicit engagement with energy justice frameworks. Despite the development of an embryonic set of literature around these themes, an obvious research gap has emerged: can energy justice and transitions frameworks be combined? This paper argues *that they can. It does so* through an exploration of the multi-level perspective on sociotechnical systems and an integration of energy justice at the model's niche, regime and landscape level. It presents the argument that it is within the overarching process of sociotechnical change that issues of energy justice emerge. Here, inattention to social justice issues can cause injustices, whereas attention to them can provide a means to examine and potential resolve them.

1. Introduction

Amidst serious sustainability challenges, transitions frameworks have evolved to either conceptualize or facilitate decarbonised energy systems that provide both security of supply and universal access to energy; a process that it is widely acknowledged will require new ways of producing, living and working with energy (Bridge et al., 2013; Heffron and McCauley, 2018; IEA, 2008; Mernier, 2007). In aiming to implement sociotechnical solutions, governments are increasingly utilising the language of transitions, and the concept has begun to feature in the energy policies of countries including Denmark, Switzerland and the United Kingdom (UK) (Foxon, 2013; Lovell, 2007; Bolton and Foxon, 2015). In tandem, although not explicitly termed as such, key aspects of energy justice debates have been discussed, and in some cases, remedied, since at least the late 1970s and early 1980s (Halff et al., 2014; Barbour, 1980; Smil and Knowland, 1980; Richards, 1981; Parfit, 1981; Barry, 1981; Perez-Guerrero, 1982; Weiberg, 1985). This paper identifies where transitions focuses are present, the resultant material and social transformations are imbued with contestations over what is just, equitable, and right. Thus, it calls for greater engagement with the three-tenet energy justice approach (distributional justice, procedural justice and justice as recognition) when planning for more sustainable transitions. "By "energy transition" we mean "a change in an energy system, usually to a particular fuel source, technology, or prime mover (a device that converts energy into useful services, such as an automobile or television)" (Sovacool, 2016). By "transformation" or "transformational change" we refer to complex, unpredictable, frequently unprecedented and radical outcomes (Roggema et al., 2012: 2530)."

Scholars frequently envision the process by which sustainability transitions take place to be one of transformative change through transformative innovation (Hiteva and Sovacool, 2017; Schot and Steinmuller, 2016; Markard et al., 2012; Wilson and Tyfield, 2018; Wilson, 2018; Geels, 2018; Dütschke and Wesche, 2018). As a result, those advocating for transformational change sometimes argue that it has the potential to present more inclusive, robust solutions to sustainability challenges because it involves stakeholders from the outset, whether they are large organisations or small NGO groups that can effect grassroots change (Schot and Steinmuller, 2016). For instance, Linnenluecke et al. (2017) identify that planning for transformational change recognises that environmental challenges present opportunities to meet the (currently unmet) needs of those at the 'bottom of the

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pyramid' – including the poorest of the poor (see also Bezboruah and Pillai, 2013; McAlpine et al., 2015; Tebo, 2005). Lawhon and Murphy (2011) outline that the concerns of small groups can be overruled by political or investor interests. There appears, then, emerging consideration for particular sectors of society who are seen to deserve more just outcomes.

Yet despite ongoing debates about ethics or justice across many fields of literature (including extended discussions between antagonist camps that have gone on across the history of political philosophy), one social element missing from transitions frameworks is explicit, practice-oriented engagement with the energy justice concept and related approaches to justice concerns. Eames and Hunt (2013) draw attention to the fact that considerations of equity and justice are underrepresented within the sociotechnical transitions literature and the wider energy transitions debate, despite the fact that the concept of sustainable development, the target of many transition plans, is inherently rooted in these core notions (Hopwood et al., 2005). Transitions literatures can also fail to give due consideration to issues of landscape, health and existing property values too (Jefferson, 2017).

Failure to adequately engage with questions of justice throughout the transition process is dangerous. It may lead to aggravated poverty, entrenched gender bias and non-participation as outcomes or by-products of 'blinkered' decision-making. Indeed, without a focus on justice, transitions may fail to acknowledge the burdens of having too much energy, such as waste, over-consumption and pollution, or from not having enough, where some individuals lack access, are challenged by under-consumption and poverty, and may face health burdens and shortened lives as a consequence of restricted energy choices (Sovacool et al., 2016a). This paper therefore utilizes the energy justice concept as a way of engaging with these ethical dilemmas *within* pre-existing transitions frameworks.

The paper proceeds as follows. The next section gives brief background on the format of the energy justice concept and one of the most dominant transitions models, the multi-level perspective (the MLP) on socio-technical systems—text we purposefully keep short both as it will largely be familiar to readers of this journal, and also to allow a focus on our main areas of development. Following this, the proceeding sections deliver the core conceptual advances, a proposed structure for linking the energy justice and technological innovation within the MLP. The final section concludes with a synthesis of the earlier arguments and a reflection on future research.

Throughout, we present three main claims, each coinciding with a level in the MLP model; the niche, regime, and landscape:

(1) That the energy justice concept can expose exclusionary and/or inclusionary technological and social niches before they develop, leading to potentially new *and* socially just innovation;
(2) That in addition to using the MLP to describe regimes, the energy justice framework provides a way for these actors to normatively judge them, potentially destabilising existing regimes using moral criteria;
(3) That framing energy justice as a matter of priority at the landscape level could exert pressure on the regime below, leading to the widespread reappraisal of our energy choices, and integration of moral criteria.

Across all of its parts, the paper emphasises the need for *socially just* sustainable energy policy as part of the re-imagined transition policy agenda. We frame this as a fundamentally political process as recognition that energy justice can only be inserted into the MLP process if there is political support for it and if we understand political tensions and trade-offs it presents. Whilst several studies have emerged that consider the role of energy justice in the sociotechnical transitions process (Mullen and Marsden, 2016; Eames and Hunt, 2013; Fuller and Bulkeley, 2013; McLaren et al., 2013), we believe this is the first to explore the role of energy justice in the MLP model.

2. New directions: Integrating energy justice and sociotechnical transitions theory

First, we briefly describe the energy justice challenge and framework and the MLP model before Section 3 goes on to explore the approach to and benefits of combining them.

2.1. The energy justice dimension

The origins of the energy justice literature is largely reported as coming from activist accounts of energy issues using the environmental justice frame - a precursor to the energy justice concept which shares overlapping philosophical groundings (Jenkins, 2018; McCauley, 2018e; McCauley et al., 2013). Specifically, as environmental justice is commonly defined as the distribution of environmental hazards and access to all natural resources; it includes equal protection from burdens, meaningful involvement in decisions, and fair treatment in access to benefits (see Hofrichter, 1993; Hockman and Morris, 1998; Low and Gleeson, 1998; Schlosberg, 1999). This approach forms the basis of the energy justice approach and framework. However, mentions of its core notions also appear elsewhere, including in the guise of the "three A's" of availability, accessibility and affordability. In this latter context, availability indicated the technical availability of a particular form of energy; accessibility the opportunity of those in a particular geographic location to access it and its associated services; and affordability the capacity of whole populations and sections therein to afford such energy services (see Goldemberg et al., 2000, which lists equity as one of the first goals of society, Johansson and Goldemberg, 2002; Reddy, 1985).

Across all literatures, key arguments around energy transitions have emerged, including considerations of the political economy of actors involved—the incumbents who stand to win or lose from transition processes, for example, and as a follow-on consideration, the support necessary for communities and businesses going through socio-technical change (see Harvey, 1996; Barnett, 2016; Young, 1990; Walker and Bulkeley, 2006; Walker, 2012, Schlosberg, 2013, 2004). Yet, on the whole, the 'socio-' or social element is frequently missing in the transitions literature and transition plans (see Sovacool et al., 2016a; Jamieson, 2014; Markowitz and Shari, 2012; Swilling and Annecke, 2012; Newell and Mulvaney, 2013; Goldthau and Sovacool, 2012; Hiteva and Sovacool, 2017). Eames and Hunt (2013: 58) note in this regard, that even 'a "low-carbon" transition has the potential to distribute its costs and benefits just as unequally [as historical fossil-based transitions] without governance mindful of distributional justice' or, as an extension, without attention to the issues of justice as recognition and due process – energy justice tenets we explore below. We argue that the energy justice concept provides one way of filling this gap.

Calls for transitions dynamics geared towards questions of ethics and justice must include concern for fairly distributing energy infrastructure and services, allowing equal access to decision-making, and fostering crosscutting participation of marginalised groups – a wider conception of the causes and forms of injustice present in current transitions thinking. This may also include consideration of the likely future wishes of those currently marginalised – their (and their descendants') wish to see landscapes and historical assets in the same way that proceeding generations have done, for example (Jefferson, 2017). Echoing these areas of focus, we limit the philosophical groundings of energy justice to distributional justice, procedural justice and recognition-based tenets. We utilise the framework of Fuller and Bulkeley (2013) who focus on the application of distributional justice and procedural justice tenet considerations in energy justice, based on the works of Rawls (1971), and, in line with McCauley et al. (2013), add to this a 'recognition-based' approach from the works of Fraser (1999, 2014).

Distributional justice[1] is concerned with the impacts of infrastructure, justice as recognition represents a concern for processes of

disrespect, stigmatisation and othering—questioning who is, or who is not, included in these decisions, and procedural justice investigates the mechanisms through which those decisions occur (Jenkins et al., 2016a, 2016b; McCauley et al., 2016, 2013).

We identify that applying these three concepts at each stage of the MLP framework provides opportunities to expose injustices, followed by the development of new means to solve them—power analysis, alternative political economic proposals, an understanding of hegemony, and capacity to do politics/build coalitions to begin to move towards solving problems, for example.

Practically speaking, energy justice is increasingly characterised as a conceptual, analytical *and* policy-oriented decision-making tool (see Sovacool and Dworkin 2014; Jenkins et al., 2017a; McCauley, 2018c and all papers from a recent Energy Justice special issue in *Energy Policy*). As one example, Heffron et al. (2015: 172) develop an energy justice metric, which is designed to connect with economists through quantitative analysis of energy justice, allowing it to be evaluated in monetary terms. Furthermore, Sovacool and Dworkin (2014) and Sidortsov and Sovacool (2015) offer an energy justice checklist, which provides a 'key questions' guide for energy decision-makers that challenges them to think about different moral criteria when developing energy projects. In this regard, the energy justice concept moves past academic discourse to non-academic application, including engagement with lawyers, economists and policy-makers (Jenkins et al., 2017a; Heffron et al., 2015; Sovacool and Dworkin 2014; Sovacool et al., 2014; Jenkins et al., 2016b). For this reason, it is thought of as an increasingly political phenomenon. To quote Healy and Barry (2017: 452) it "not simply a technological or indeed a sociotechnical matter. Indeed, since it is characterised by issues of power, distribution of and access to resources, political economy, and so on, it can be described as a deeply political struggle". As we go on to argue, each of these roles—conceptual, analytical, and politically-oriented decision-making—can be implemented through the distribution, procedure and recognition framework at each stage of the MLP approach to transitions.

2.2. The multi-level perspective dimension

One of the most prominent conceptual approaches to the sociotechnical transitions literature is the multi-level perspective, or the MLP[2] (see Cherp et al., 2018). The sociotechnical transitions literatures were predominantly developed by the 'Dutch school of transition studies' as a mode of governance for sustainable development (Jørgensen, 2012; Loorbach and Rotmans, 2010; Kern and Smith, 2008). This governance focus means that the socio-technical literature increasingly acknowledges the political dynamics related to the process through which innovations scale, diffuse or entrench. We focus here on the most prominent socio-technical transitions framework, the multi-level perspective (MLP). The MLP takes the form of a series of nested levels, the niche, regime, and landscape (Fig. 1), which aim to provide a contextual account of technological change and systems innovation over time (Bridge et al., 2013; Geels, 2002). According to Geels (2010), these levels refer to heterogeneous configurations of increasing stability. In mobilising geographical metaphors, they aim to provide a contextual account of technological change and systems innovation over time (Bridge et al., 2013; Geels, 2002). Geels (2002) stresses that these different levels do not represent ontological descriptions of reality, but instead offer analytical and heuristic concepts to aid the understanding of sociotechnical change. They represent, therefore, levels of structural and temporal scale, rather than geographic, administrative or other types of levels (Grin et al., 2011).

The MLP's niche is characterised as the lowest but most dynamic level, and it is typically considered to be the site where radical, revolutionary innovation is developed and generated (Geels, 2002; Smith et al., 2010). In fulfilling this role, niches have been conceptualised as protected spaces, specific markets for example, within which radical innovations can develop without selection pressure from the prevailing regime (Kemp et al., 1998).

The sociotechnical regime, or the meso-level of the MLP, comprises dominant institutions and technologies, and reflects the prevailing set of routines or practices that create and sustain technological systems (Foxon, 2013). It is this level that creates the existing stability of technological development (Geels, 2002), and changes slowly and 'normally' under the influence of niche and regime dynamics (Smith et al., 2010). The core concept of the regime is that it imposes logic and direction for sociotechnical change along clear pathways of development (Markard et al., 2012).

The third stage of the MLP model, the macro-level landscape, is theorised as containing slow changing external factors (Geels, 2002) – broader trends and global events, and the environmental, socio-economic, and cultural context, within which actors and institutions are situated (Lachman, 2013; Smith et al., 2005). This level represents the broader political, social and cultural values and institutions of society (Foxon, 2013); so called quasi-autonomous macro-dynamics (Grin et al., 2011).

For a fuller review of all three levels, see Geels et al. (2017). It is the interplay and dynamic between these three levels that creates or constrains technological transitions. It is only when developments at all three levels coincide that transition occurs (Verbong and Geels, 2007), with, according to current interpretations, the main drive for change occurring between the regime and the niche (Geels and Schot, 2007). Thus, overall, the MLP examines and simplifies the interactions between niche-innovations and existing regimes, situated within a broader landscape environment.

3. Energy justice at the niche level

The energy justice concept can expose exclusionary and/or inclusionary niches before they develop. We say this, as acknowledgement that whilst new renewable innovations are designed to deliver sustainability, without attention to issues of energy justice, niches may become 'exclusionary niches'. New innovations funded by large companies can lead to the exclusion of poor, indigenous communities, for example, resulting in energy justice externalities, for example recently with shale gas technologies (Cotton et al., 2015; McCauley, 2018d). We provide the short examples of electric vehicles and wind energy to illustrate our case. Before doing so however, it is necessary to address *how* this is possible. Alongside the brief mention of energy justice metrics or frameworks above, several examples are emerging. Here we refer to one: reframing. The transitions literature notes that reframing at the niche level can lead to higher level changes in social norms and values (Sol et al., 2017). To this end, Healy and Barry (2017) reference the need to shift from framings focused on energy justice, sustainability and democracy to energy *injustice, unsustainability* and *a lack* of democracy. By altering this approach, they outline that energy transitions become "a more radical, systemic and politically oppositional project" (Healy and Barry, 2017). One clear example is the fossil fuel divestment movement, which is a response to unsustainability and injustice. Framing then, can be one tangible approach for achieving politically aware (or tactical) niche developments. In contrast, failure to change political and economic conditions can, in certain circumstances, lead to stranded assets and negative emissions (Sovacool and Scarpaci, 2016).

In order to be considered 'transitional', a technology is normally identified as stemming from radical innovation (Genus and Coles, 2008) (although some transition technologies are a repurposing of

[1] We note here that we use the term 'distributional justice' in reference to the tenet framework presented by McCauley et al. (2013) and not in reference to a distributional form or theory of justice, which does not exist. Rather, it is distributive justice.

[2] The three other major frameworks are transition management (Kern and Smith, 2008; Loorbach, 2010; Rotmans et al., 2001; Kemp et al., 2007), strategic niche management (Kemp et al., 1998; Raven and Geels, 2010; Smith, 2007) and technological innovation systems (Bergek et al., 2008; Jacobsson and Johnson, 2000; Hekkert et al., 2007).

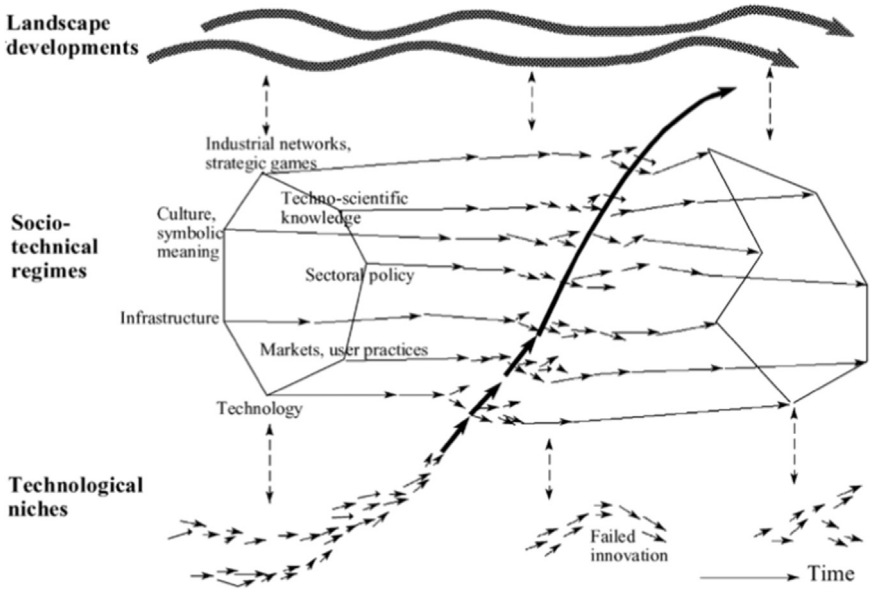

Fig. 1. A Dynamic multi-level perspective of STS.
(Source: Geels, 2002).

current or older technologies, including comparatively low tech solutions such as insulation retrofit and small-scale wind). We acknowledge that there can be some challenges differentiating niches from regimes. Despite being a comparatively new low-carbon technology in its commercial sense, wind or solar, for example, could arguably be classed as advanced enough to be 'regime'. Thus, we add the caveat that our aim is not to discuss what a new, 'niche' technology is, but only to demonstrate the role of energy justice considerations at the innovation, development and generation stage of technologies.

Analysis through the energy justice lens reveals that although electric vehicles (EVs) do have laudable environmental (and social) attributes, they can be exclusionary in the sense that they can perpetuate already widening gaps between the wealthy and poor, as well as potentially raising new forms and geographies of injustice – distributional and justice as recognition concerns.

The consumption of mobility and transportation modes already reflects, and may reinforce, patterns of recognition-based inequality. Banister and Anable (2009) noted that in the UK, for instance, those in the highest income quintile travel nearly three times further than those in the lowest quintile. As Wells (2012: 751) cautions, "mobility, or the lack thereof, has long been recognised as an important aspect of exclusion, inequality and poverty". A recent National Grid report presents a scenario in which electricity consumption continues to peak as EV's are taken up and relatively disengaged, affluent consumers are content to charge during peak times (National Grid, 2017). Moreover, transportation infrastructure and technology developments often benefit middle and upper class citizens because: they cater to their transportation needs (the development of suburban highways, for instance); pollution and congestion often build in poorer neighbourhoods; and poor residents are more likely to be displaced or have their neighbourhoods disrupted due to developments (Roth, 2004; Kaufmann and Jemelin, 2003).

It may come as no surprise that EVs, a niche within the existing transport regime, can perpetuate and solidify these disparities, as well as present potentially new ones. For instance, distributionally, EVs shift pollution from local tailpipes to power plants, making it a transboundary issue as pollution shifts to more regional distribution patterns (Buekers et al., 2014). Early adopters of EVs tend to be both wealthy and older than ordinary drivers (Wolf and Seebauer, 2014; Axsen and Kurani, 2013; Axsen et al., 2016), and to utilise them as second cars so that drivers had another, conventional vehicle at home to offset range anxiety (Neubauer et al., 2012). A stated preference survey conducted in the UK revealed that higher income group is more likely to consider an EV as a second vehicle (Skippon and Garwood, 2011). In some cultures such as China, EVs are perceived as an elite and luxury consumer technology (Tyfield et al., 2014). Lastly, EVs as private cars still endorse a paradigm of private vehicle ownership. Those that rely on private transport have higher rates of diabetes, cardiovascular disease, and obesity than those who walk or take public transport (Woodcock et al., 2007). As one international team of health experts put it, 'increasing use of cars improves access for those individuals who are newly motorized but reduces access for others through danger and congestion' (Woodcock et al., 2007: 1082). In this context, private EVs can be as negative as private conventional vehicles.

Wind turbines, also, have sustainability benefits, but can be exclusionary in outsourcing, offshoring, or exporting pollution flows and embodied emissions of things like carbon dioxide. It is also misleading when done, not to take "embodied emissions" fully into account. Sovacool et al. (2016b) examined the externalities from manufacturing offshore and onshore wind turbines for use in Northern Europe, and found that wind energy has externalities across its construction and manufacturing. These included noxious emissions of hazardous air pollutants such as particulate matter, ozone, sulphur dioxide, and nitrogen oxide, as well as solid and electronic waste streams. These pollution flows both offset (in part) their environmental credentials and also result in significant emissions being outsourced to China and South Korea. Taking into account 'environmental profits and losses', the study estimated that China and South Korea accounted for about 80% of embodied emissions and resulting environmental damages across each type of turbine.

Applied at the development stage of this technology, an energy justice approach and analysis identifies such sources and forms injustices from the outset. This is not to disparage the drive to transition to low carbon and renewable technologies, which is a critical objective of energy justice (Heffron and McCauley 2017; McCauley, 2018a). This exposure of new injustices allows for the development of appropriate procedural justice mechanisms that cement the socially integrated, socially just development of the technology, with benefits for social acceptance and as an outcome, successful technology roll out. Appropriate framing can develop the political motivations to do so.

4. Energy justice at the regime level

In addition to applications in niches, the energy justice framework can support the current role of the MLP to describe regimes by providing a means for policy actors to normatively judge them—exposing unjust practices and resultantly, increasing regime 'humanisation'. We illustrate this first through the exploration of nuclear power and hydroelectric power production, regimes in which there is some consensus that technological development and lock-in raises issues of justice, or injustice. We identify that the metrics, frameworks, or checklists presented above – as well as the three-tenet framework of energy justice more generally – provide a means of normatively judging both planned and current energy and future sociotechnical regimes, leading to potential re-evaluation of our energy selection criteria. These approaches also recognise the need to politicise the actualisation of energy justice itself.

Nuclear output has increased from 0.9% to 4.8% between 1971 and 2016 in terms of its percentage share globally of total primary energy supply by fuel. China and Korea have notably experienced significant growth during this period, whilst the global leader of nuclear electricity production is the USA, closely followed by France (IEA, 2017). The power source is associated with a well-known set of risks and perceived injustices (extensive coverage of which is given by Endres, 2009; Cotton, 2009; Butler and Simmons et al., 2013; Hoffman, 2001; Shrader-Frechette, 2000, amongst numerous other authors). For Sovacool (2011) distributional justice and justice as recognition concerns include the fact that nuclear power is inherently associated with injustice through global events, increased incidents of cancers, dependence on finite uranium resources, toxic pollution of the environment and terrorist threats, amongst others. Of course, fossil fuels are explicitly associated with equally negative connections to human health implications over a much longer timeframe (Maiangwa and Agbiboa, 2013; Martinez et al., 2007; McCauley, 2018d). Despite these negative consequences, in some instances, nuclear energy has undergone explicit reframing by the pro-nuclear lobby in the face of the intersecting agendas of climate change, decarbonisation and sustainability, seeing it recast as a potential means of securing both security of supply and climate change stability, and a technology many are reluctantly willing to accept (Cotton, 2017; Pidgeon et al., 2008; Poortinga et al., 2006).

In 2008, for example, the United Kingdom (UK) government reversed its decision to decommission all nuclear power plants by 2025 in England and Wales, announcing instead that new nuclear would play a role in low carbon electricity generation (Doyle, 2011; Jenkins et al., 2016a). As a result the UK has developed a (now delayed) strategy to deliver around 16 GW of new nuclear by 2030 (BIS, 2013). Taebi and van de Poel (2015) outline that alongside the 30 countries that currently produce nuclear energy, another 45 have expressed interest in developing the technology. The ensuing questions of facility siting, hosting, the possible treatment of nuclear waste, the transfer of waste to the host sites, monitoring and final closure of stations all carry significant socio-technical and justice implications (Taebi et al., 2012; Landström and Bergmans, 2014).

As a second example, hydropower is a well established global energy regime as the leading renewable source for electricity generation globally (WEC, 2017). However, the establishment of a global regime in hydroelectricity has threatened ecosystems, water quantity and quality as well as human rights (McCauley, 2018b). The construction of hydroelectric power plants has resulted in social and ecological destruction and injustice (Kayir, 2017). The planning, construction and operation processes have dehumanised, dispossessed and impoverished communities. Examples are rife in current academic literature including (but not limited to) several African countries (Green et al., 2015), Canada (Loo, 2007), India (Khan, 2012), Japan (Maruyama, 2012), Laos (Mirumachi and Torriti, 2012), Mozambique (Sneddon and Fox, 2008), Portugal (Marques et al., 2015), Thailand (Sneddon and Fox, 2008) and Turkey (Hommes et al., 2016). From an energy justice perspective, policy actors must explicitly consider the competing dichotomy of the 'morality of increasing energy provision' versus the 'morality of environmental and social protection'. Considering the inequalities of the latter, the sustainability of hydropower must surely be questioned.

Whilst the energy justice concept is limited in its capacity to entirely resolve the complex issues raised by nuclear power, in the context of its on-going expansion as part of a socio-technical transition, the procedural justice tenet plays an important role in making sure that these decisions are made with due process. Moreover, analysis of distributional and justice as recognition tenets may lead to the questioning of whether the 'morality of risk' or 'morality of climate change' is of most importance to wider society, and therefore whether nuclear is the right choice for future energy mixes. Depending on the outcome of these evaluations, this would have a knock-on effect on sustainable energy mixes.

5. Energy justice at the landscape level

Whilst much of the existing literature on sociotechnical systems has been dedicated to understanding niche innovations and regimes (Kemp et al., 1998; Lopolito et al., 2011; Smith and Raven, 2012), this has come at the expense of understanding landscape dynamics, the top level of the MLP. This section focuses on the idea that framing energy justice as a matter of priority at the landscape level could exert pressure on the regime below through larger cultural shifts, for example in attitudes toward multinational business or to state intervention in markets generally. This, in turn, could lead to the reappraisal of our energy choices and integration of moral decision-making criteria.

Despite their acknowledgement that the landscape contains static or slow changing factors, such as the physical climate and demographic shifts, Van Driel and Schot (2005) also attribute the landscape level with a degree of dynamism. This includes, predominantly, rapid external shocks such as war or oil price fluctuations as landscape dynamics. Whitmarsh (2012) also identifies a number of pressures on this landscape in the form of the environmental challenges of climate change, the economic challenges of oil prices, and the cultural challenge of value and behaviour change. This case can also be made using the example of nuclear energy. Hermwille (2016); Markard et al. (2016); Cotton (2014) demonstrate that the rapid external shocks of the Fukushima nuclear disaster had significant impact on the energy sectors in Japan, Switzerland and Germany, with strong effects for the on-going structural change of sociotechnical systems.

Geels (2010: 495) explains that niches, despite being relatively slow moving, can break through if the landscape level 'creates pressures on the regime that lead to cracks, tensions and windows of opportunity'. Thus, landscape factors can exert pressure on the regime challenging regime stability (Morone et al., 2015). To illustrate such mechanisms, Kuzemko et al. (2016) outline that new scientific knowledge on climate change has placed pressure on the lower two levels of the MLP, fostering widespread change to low-carbon technologies. Furthermore, Leiss (1978) offers the classic example that the rise of consumer culture based on individual definitions of needs, channelled through to expanding commodity consumption. Energy justice can arguably undertake a similar role, where the reframing of energy decision-making (including whether or not to accept fracking due to its justice implications, for example) as ethical issues can affect which technologies we select as part of our energy mix in the regime level. It follows that transition plans need to incorporate notions of energy justice.

Morone et al. (2015) offer a functionally-driven understanding of the landscape level, suggesting that it is an external context for actor interactions where a range of local, national and global stakeholders can create pressure upon the regime level through social, political and economic channels, in keeping with Kuzemko et al. (2016)'s climate change argument given above. Thus, it is the framing of energy justice as a matter of priority alongside the motivations of energy security and environmental protection that could lead to reappraisal of our energy

choices, and integration of moral criteria.

From a global production viewpoint, a key injustice in energy is the over-reliance of today's global societies on the historically embedded production systems of fossil fuels to satisfy growing energy demands (McCauley, 2018c). According to the International Energy Agency (IEA, 2016), the world is producing more than double the quantity in terms of total primary energy supply today than in 1973. In both these early years and the interim period, fossil fuels heavily dominate the world's energy production. An adoption of energy justice at the landscape level would involve multiple institutions actively pursuing alternative fuels. For global consumption, organisations would prioritise energy access in the same way as water or food. As for individual systems, rather than national considerations of security of supply the global justice footprint of each natural system would be taken into account when deciding on whether to follow a given technology such as nuclear.

Of course, it would be remiss not to acknowledge that such a framing at the landscape level is a political process. Meadowcroft (2011: 73) writes, for instance, "that the politics of sustainability transitions [and by extension energy transitions] requires a redefinition of societal interests and this implies political engagement to build reform coalitions, create new centres of power, buy off powerful lobbies, isolated die-hards, compensate losers, and so on". As an illustration, the controversy around ExxonMobil's climate change communications is one example where the politicisation of fossil fuels provides scope for the energy justice approach. Supran and Oreskes' (2017) research outlined what may have been attempts from ExxonMobil to mislead the public concerning whether climate change is real and human caused. They claim this on three counts: (1) discrepancies in climate change communications between the types of documents ExxonMobil produced (whether internal or external, and depending on their degree of public accessibility), (2) the imbalance of different document types, and (3) factual misrepresentations in some advertorials. In light of such accusations #ExxonKnew became a public tool for expressing anger, later evolving into a petition to the United States Department of Justice and State Attorneys General. In this regard, litigation played a role in changing the norms around fossil fuels in response to public pressure. Energy justice can take on a similar role and build on and contribute to such instances.

6. Conclusions, policy recommendations and recommendations for future research

Energy decisions are all too frequently made in a moral vacuum, culminating in a strong normative case for combining the literature on sociotechnical transitions with concepts arising from energy justice. Moreover, we illustrate that energy justice can play a role at each level of one of the more expansive sociotechnical transitions frameworks, the MLP. Within this latter contribution, (1) the energy justice concept could expose exclusionary niches, (2) provide a means for actors to normatively judge regimes, and (3) through the framing of energy justice at the landscape level foster the reappraisal of our energy choices and integration of moral principles. Across all stages of this argument, we present a case for not only mitigating environmental impacts of energy production via sociotechnical change, but doing so in an ethically defensible, socially just way.

This challenge is not simple, of course. As a globally persistent problem, justice concerns share commonalities with various crises that, according to Grin et al. (2011), represent the dark side of dominant patterns of socio-economic-technological development, and are difficult to resolve. By the same token, processes that are firmly embedded in societal structures cause injustice, and as a consequence, dealing with injustice across our energy systems and sectors involves both innovative practices and structural adaptation. Nonetheless, the transitions approach could be mobilised to understand the complex dynamics of how processes of justice and injustice occur through the system, or can be managed. At the same time, an investigation of such processes would provide a different lens through which transition scholars may understand, expand or renew core assumptions of sociotechnical transitions. In the countries were transitions lenses are taken in current policy approaches, we therefore recommend that justice be embedded as a core notion during both policy analysis and policy process. For countries exploring the evolution of poverty or justice concerns, transitions frames will provide profitable insights.

Of course, this argument comes with a number of caveats or 'practical pitfalls'. We identify two as indicative examples, acknowledging that many more may exist. As Lawhon and Murphy (2011) suggest that those wielding greater power in the sociotechnical system – political and industry elites – are likely to have their own interest favoured unless mechanisms are established to limit their influence. In this case, this may manifest as continued inattention to questions of ethics, morality and justice. Here we point to the idea that policy and industry groups have a higher *degree* of responsibility, not sole responsibility for just outcomes (Jenkins et al., 2017b). Therefore we cast wider society as the assessors of just energy practices. This reflects a policy recommendation by Jefferson (2008: 4123) that we must 'move away from the fashion of "big government", the empowerment of bureaucrats, and the "target culture" towards putting more power and financial resources into the hands of communities and the household'. Additionally, Eames and Hunt (2013: 50) note that transitions are not the outcome of a change in a single variable – the introduction of a new law, for example – but instead are the outcome of complex, mutually reinforcing, changes across several domains that involve societal actors (Fouquet, 2016; Grubler et al., 2016; Smil, 2016; Sovacool and Geels, 2016). In this regard it seems futile to believe that such approaches can foster truly 'just transitions' without the framing of energy justice as a core concern for wider society, and therefore a pressure on a range of regime actors.

Our caveats come as recognition of the intricacies of politics and political processes around energy transitions and energy justice. For as Meadowcroft (2009) highlights, long-term change is likely to be even messier and more contested than the transitions literature discusses. Indeed, there are likely to be political aspects that approaches such as the MLP are ill equipped to negotiate, and trade-offs that a tenet approach to energy justice cannot entirely resolve. Furthermore, Shove and Walker (2007) outline that despite extensive debate around the construction and democratic choice of visions of the future, the extent of the politics involved can be underplayed. Here, particular sociotechnical systems may appear unproblematic in their desirability but others are clearly not. In essence, there are conflicts around "the appropriate" and we must be cautious of sustainability as a legitimising discourse.

Nonetheless, despite the acknowledged difficulty of translating transitions from theory – which often occurs whether there is a concern for social justice or not – a social justice perspective *is* required to complement the conventional focus of energy studies on the costs of certain energy choices and technologies in order to fulfil the emergent moral vacuum in energy transitions research. This expands the normative drive for sustainable transitions to acknowledge the justice principles on which such concepts are founded.

Fairness must be at the heart of our policy response to growing energy demand. The global energy system presents humanity with three key challenges. We need, firstly, to secure enough resources to meet the rising energy demands from notably emerging economies such as India: the transition from fossil fuels to renewables should not threaten basic energy requirements. Such demands come from people, not just economies. Secondly, all parts of society must have access to energy. It is vital that energy is recognised as a necessary commodity for human life, just as much as food or water. The third challenge involves a global commitment to long term sustainable energy resource extraction, generation and waste related processes.

To conclude, in addition to the early exploration of this agenda introduced above, we identify two potential new areas of further

research that may advance these ideas and the field further. One, we advocate for more explicit consideration of agency, power and politics in transitions, and indeed energy justice, research (e.g. Geels, 2014). Two, we identify the need for greater consideration of non-traditional actors in transitions, including the roles of users (Schot et al., 2016), with due consideration given to marginalised groups as (non-)users. Beyond users, a consideration of non-dominant and non-state-based actors in shaping transition processes is also necessary (Seyfang and Smith, 2007). These elements and approaches have implications for understanding the dynamics of energy justice, but also of transitions in general, and they may fruitfully encourage that future scholars to refine their normative critical thinking faculties alongside their analytical and descriptive skills.

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